

# City of Memphis Maynard C. Stiles Wastewater Treatment Plant Disinfection Improvements

## Pilot Study Phase 1 Summary January 16, 2015

### Background

The objective of the full-scale peracetic acid (PAA) pilot study is to identify the best disinfection control strategy to achieve compliance with the future NPDES permit disinfection limits under varying flows and influent quality conditions. The Pilot Study Work Plan, previously developed and approved in 2014, includes a description of Dose Control Strategy, Phases of Testing, Data Analysis, Pilot Study Management, and Additional Industrial User Testing to be conducted.

The pilot is being conducted in phases; the first four include development of information on the best means of providing dose control. A fifth phase will be used to demonstrate efficacy of the final process control algorithm. Data collected during the pilot will be used to inform the final design of the dose control for the full-scale system design. This document provides a summary of the results of Phase 1.

### Phase 1: Implementation

The wastewater from the north and south sides of the plant meet and discharge into the mixing compartment at the head of the contact tank. The combined flow is split into two parallel, serpentine contact channels. Pre-disinfection water quality is assessed at the head of the disinfection channel that is not receiving PAA. The following water quality parameters are being measured continuously on-line, as follows:

- Color - ChemScan UV-3151 series flow-thru sensor
- Chemical Oxygen Demand (COD) - YSI CarboVis 701 submersible probe
- UV Transmittance (UVT) - YSI CarboVis 701 submersible probe
- Oxidation-Reduction Potential - ORP Prominent submersible Dulcotest Probe

Phase I was implemented from December 5 – 15, 2014 and during this period, PAA was fed using dose pacing. The PAA dose was initially set at 10 ppm; and was increased to 15 ppm on December 11 at 8:10 am. PAA residuals were measured throughout the disinfection channel by three separate, Ducotest Amperometric PAA sensors, P1, P2 and P3, as shown in Figure 1. Bacterial samples were also collected at several locations throughout the basin during testing, with locations also shown in Figure 1.

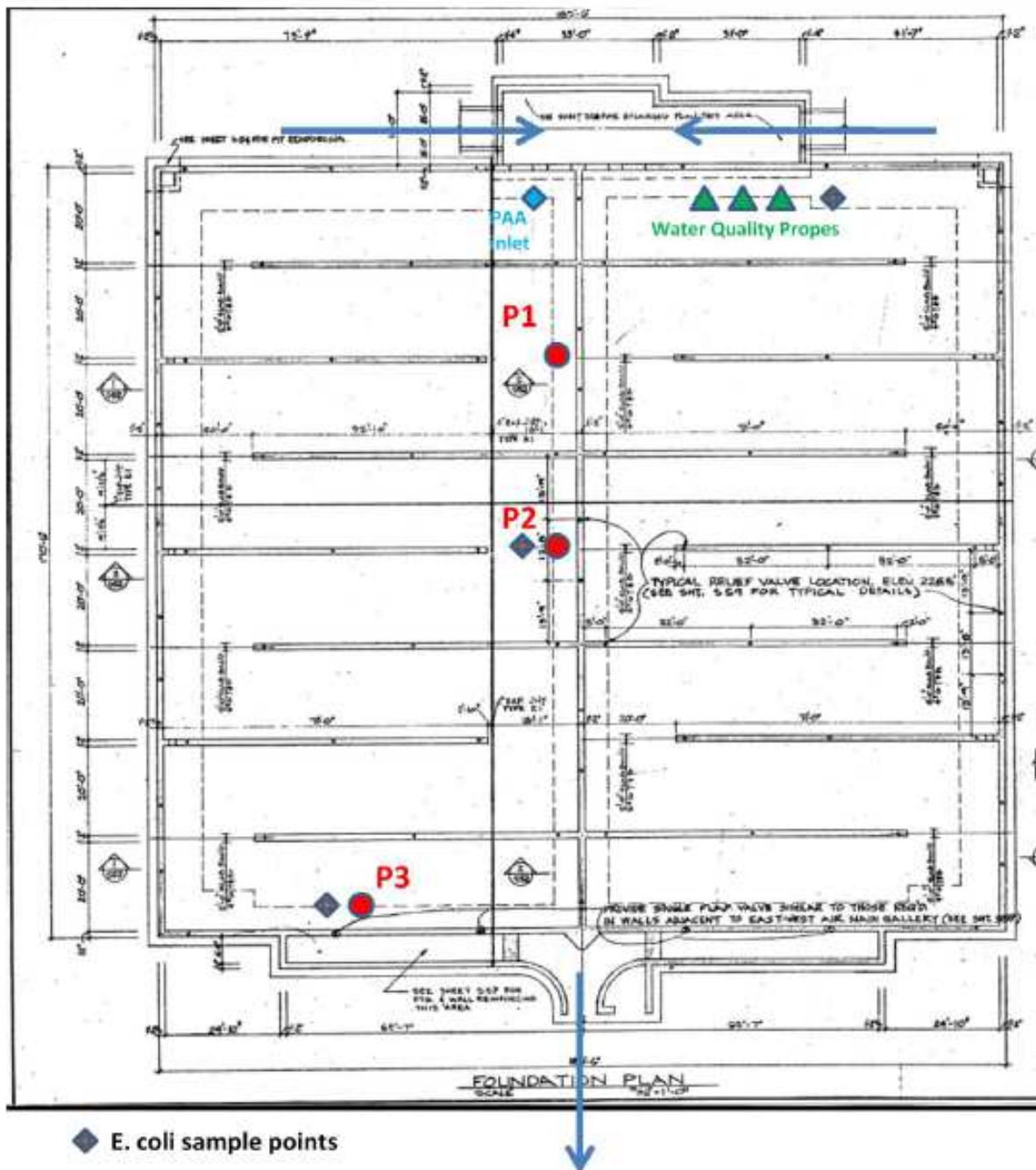


Figure 1. Water quality monitoring and sampling locations in disinfection contact tank.

### Phase 1: Results

Results of effluent color and COD collected during Phase 1 are provided in Figure 2; results of UVT and ORP are provided in Figure 3. The PAA residuals at P2 and P3 were near the detection limit of the analyzer throughout the phase and are not shown; as a result, the analysis of Phase 1 data is based on the residuals reported at P1, which are shown in Figure 4 along with E. coli results.

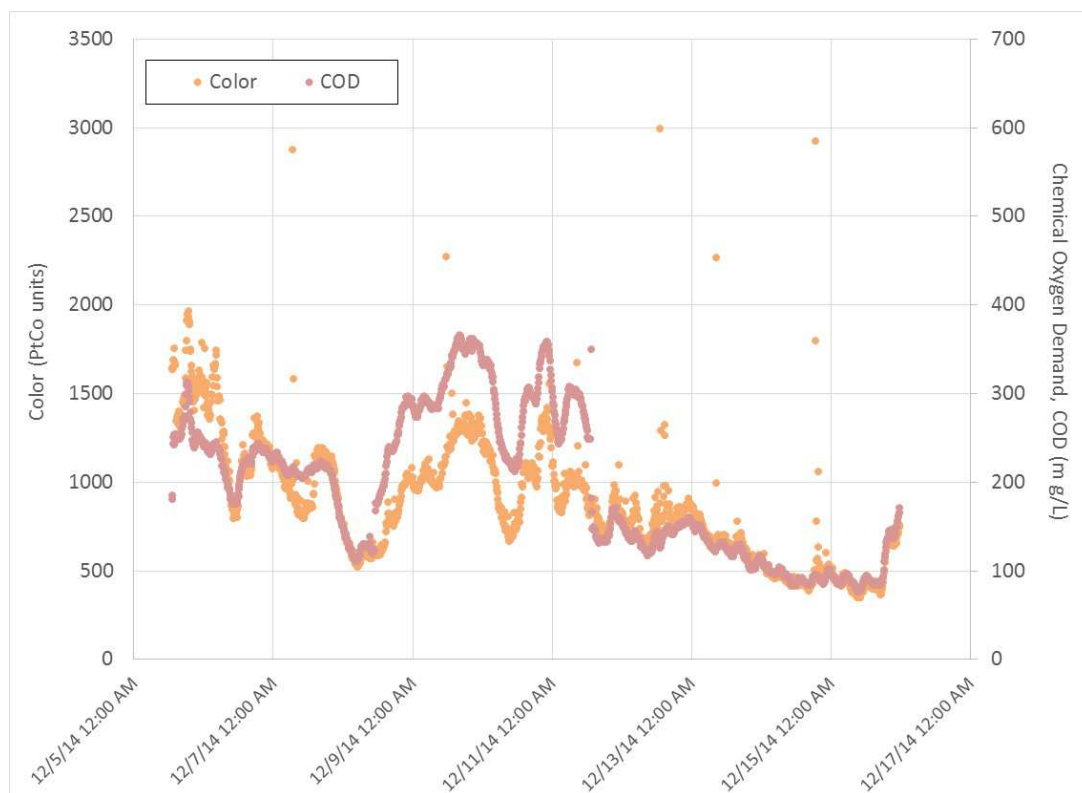


Figure 2. Color and COD measurements during Phase 1.

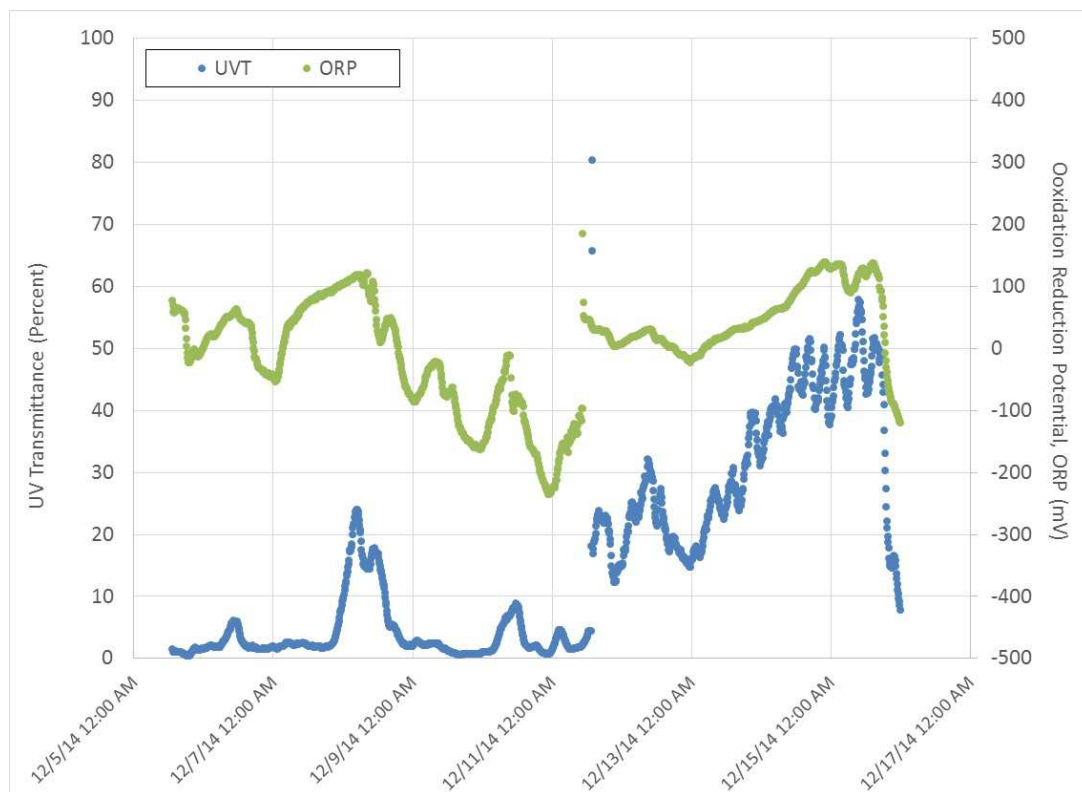
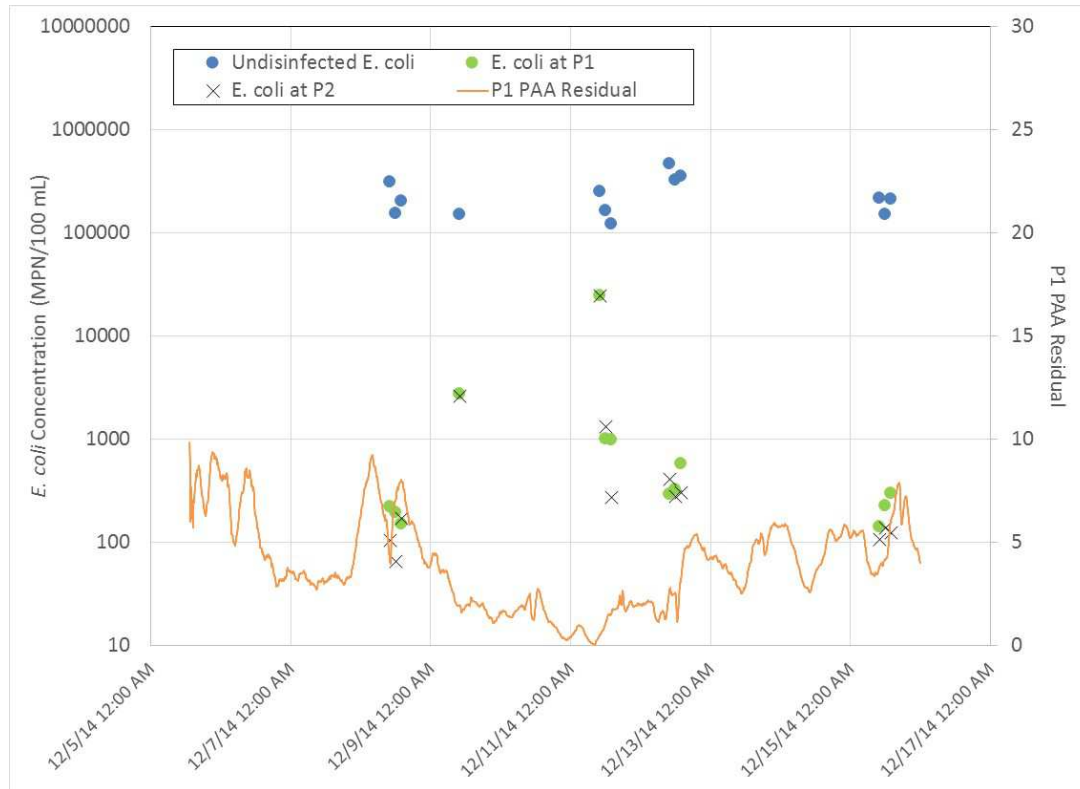


Figure 3. UVT and ORP measurements during Phase 1.



**Figure 4. PAA residual at P1 and *E. coli* measurements during Phase 1.**

### Recommendations for Testing in Next Phases

Based on the initial results, the following will be carried out in future Phases of work:

- UVT is not a good process control parameter because of the small range of values that are measured; additionally, UVT values are near zero when color is high, so scaling for process control is limited at these ranges and this parameter will be eliminated from further testing.
- ORP has limited applicability because it could not be correlated to disinfection performance; therefore this parameter will not be carried forward into future phases of testing.
- Color and COD were both readily correlated to disinfection performance; these parameters will be carried into Phase 2 and 3 of testing.
- Because there is no statistical difference in the *E. coli* results between samples collected at P2 and P3, the *E. coli* sampling location located at P2 will be relocated to the P1 location commencing in Phase 2, which will allow additional information to be collected on disinfection kinetics.

Phase 2 commenced on January 7, 2015 at 8 am, using wastewater color as the feed-forward parameter for the dosing scheme. The initial Phase 2 set point for PAA will be 10 ppm; as color increases, the dosing will be increased based on the correlation developed from data collected during Phase 1 to test the feed forward algorithm that has been developed for this site. Testing will continue for 10 days after which, Phase 3 will be initiated. Phase 3 will be similar to Phase 2 with the exception that the feed forward parameter will be COD. Data from Phase 2 and 3 will be summarized together in the next pilot update.